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(54) **Method and apparatus for monitoring remote devices by creating device objects for the monitored devices**

Verfahren und Vorrichtung zum Überwachen entfernter Geräte durch Erzeugen von Geräteobjekten für die zu überwachenden Geräte

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**Description**

[0001] The present invention relates to monitoring, configuration or installation of hardware on a computer system.

5 Discussion of the Background

[0002] In general, computer systems include hardware and software. Hardware is the actual physical computing machinery, while software is the list of instructions to operate the hardware. Typically, computer systems will include a variety of hardware devices that interface with one another. When hardware devices interface with one another, it is necessary for the software which operates the hardware to be configured to allow communication between the hardware devices, so that the hardware devices can operate cooperatively. It is also desirable for hardware devices to be monitored. For the purposes of discussion, a hardware device that is configuring or monitoring will be referred to as a controlling device. Likewise, for the purposes of discussion, the hardware device that is being configured to operate cooperatively or being monitored by the controlling device will be referred to as an interfacing device.

15 [0003] When hardware devices initially interface with one another, it is common for the software that operates the devices to remain unconfigured to allow cooperative operation. Accordingly, a significant part of installing computer hardware devices collectively configure the software. In some arrangements, a user must configure the computer hardware manually by opening the computer hardware and physically setting jumpers or dip switches. In still some further arrangements, the installation process includes a user loading software from a floppy disk to configure the hardware devices. There have also been attempts for computer hardware devices to include software that can automatically configures hardware devices. There are, however, some apparent disadvantages and deficiencies with respect to the above-identified approaches.

25 [0004] One disadvantage is that automatic hardware installation software is limiting in its ability to adapt to new devices or to new manufacturers that were not specifically programmed into the software. In the prior art, if the controlling device does not recognize the specific model of the interfacing device, automatic configuration is not possible. In other words if the controlling device is not programmed to anticipate the model of an interfacing device, then automatic hardware configuration will not be successful. In such a circumstance, a user will have to manually install the configuration communication means to the hardware devices.

30 [0005] Another disadvantage of the prior art is that the controlling device is unable to partially configure hardware devices if the particular model of the interfacing device cannot be identified. In other words, if a controlling device cannot identify a specific model of the interfacing device, then the interfacing device will not be configured to function cooperatively. This results in the unconfigured interfacing device being inoperable and essentially useless.

35 [0006] It is desirable for hardware devices located on a network to be monitored for maintenance, usage, or other purposes. However, it has been difficult for a controlling device to communicate with various interfacing devices on a network given the different communication means between manufacturers and models of interfacing devices. These disadvantages prevent network administrators from obtaining crucial information about the performance and efficiency of interfacing devices on a network.

[0007] DE-A1-100,22,491 discloses updating a driver on a PC over the internet.

[0008] US 5,546,595 discloses an object-oriented hardware configuration system.

40 [0009] The present invention relates to a method of establishing a connection between at least one device and a monitoring system, an apparatus adapted to establish a connection to at least one device, a computer program comprising program code means that, when executed on a computer system, instruct the computer to perform the method and a system having at least one network connected device.

45 [0010] More specifically, a method and apparatus for easily creating device objects representing the monitored device is described. Initially, the controller/monitoring system attempts to establish communication with the monitored device. If the controller cannot be configured to interface with the monitored device, configuration information, such as manufacturer, model, and a unique identifier from the monitored device are obtained. In the process of determining the configuration information, a determination is made to find out if the monitored device is supported by the controller using information from System Support Database (SSD). A device object is created using information from the SSD, thus establishing a communication protocol between the controller and the monitored device. Subsequently, configuration information for the monitored device is updated in the System Configuration Database (SCD).

50 [0011] Two databases are used to configure devices with systems. These embodiments are advantageous, as valuable computer resources are used during the initialization of the devices with a system while preserving the computer resources during system operation. For example, a system may utilize two separate databases when a device is being configured. The first database (i.e. a System Configuration Database) stores device information for devices that have already been configured to the system and wherein operational status information of the devices is stored as the devices are being monitored by the system. Such device information may include the manufacturer name, and model name while operational status information may include the page count and toner level.

[0012] The device information stored in the first database is utilized during the initialization of the system while the status information stored in the first database is accumulated during the system operation. The first database, therefore, will be large since it will contain status information. Consumption of computer resources is, however, minor since the device information is used during initialization while status information is only added when the system is in operation.

5 [0013] The system of the present invention also utilizes a second database (i.e. System Support Database). This second database may be relatively large as it would include data pertaining to a plurality of devices. When a device is initialized with a system, and the system is not yet configured to interface with the device, then the first database (i.e. System Configuration Database) can be updated using the information from the second database (i.e. System Support Database) so that the device can interface with the system. Due to the large amount of information stored, querying the  
10 second database is not only time consuming but also uses a large amount of valuable computer resources. Once, the critical information (i.e. protocol) relating the device is updated in the first database with information from the second database, only the first database is utilized.

[0014] In one aspect, the present invention provides a method of establishing a connection between at least one device and a monitoring system, said at least one device and said monitoring system being communicatively coupled  
15 via a network, the monitoring system being communicatively coupled to first and second databases, the method comprising the steps of:

(a) determining if the monitoring system is configured to interface with said at least one device;

20 (b) obtaining configuration information from said at least one device if the monitoring system is not configured to interface with said at least one device;

(c) determining if said at least one device is supported by the monitoring system using information stored in the second database;

(d) creating a device object using information stored in said first and second databases to establish communication between said at least one device and the monitoring system, wherein the device object includes references to  
25 configuration information stored in the first database, the references using vectors or arrays; and

(e) updating configuration information, for said at least one device, stored in the first database with configuration information stored in the second database to enable the monitoring system to interface with said at least one device, thereby allowing flexibility in the creation of device objects.

30 [0015] The step of obtaining configuration information from said at least one device preferably includes identifying at least one of (i) manufacturer, (ii) model of the device, and (iii) IP address of said at least one device. The configuration information is only used during initialization of the monitoring system to identify said at least one device, that requires monitoring. The step of determining if the monitoring system is configured to interface with said at least one device preferably includes querying the first database with at least one of manufacturer, model, and IP address of said at least  
35 one device.

[0016] The step of determining if the monitoring system is configured to interface with said at least one device comprises querying said at least one device with data stored in the first database. The first database is a system configuration database which includes information for enabling communication between the monitoring system and said at least one device; and status information related to said at least one device, the status information being added after initialization  
40 of the monitoring system for monitoring said at least one device. The second database is a system support database and comprises information about various manufacturers and device models supported by the monitoring system.

[0017] The step of determining if said at least one device is supported by the monitoring system further includes obtaining detailed status information of said at least one device being monitored if the manufacturer and model of said at least one device are supported by the monitoring system. The device object allows the monitoring system to communicate with said at least one device and determine information that needs to be obtained from said at least one device.  
45 The at least one device object preferably stores references to information using vectors or arrays. The device object further stores references to information includes object identifiers. The device preferably includes hardware or software components.

[0018] In another aspect of the present invention there is provided an apparatus adapted to establish a connection to  
50 at least one device communicatively coupled via a network based system, the apparatus comprising: a monitoring system communicatively coupled to the network; first and second databases communicatively coupled to the monitoring system; means for determining if the monitoring system is configured to interface with the at least one device; means for obtaining configuration information from said at least one device if the monitoring system is not configured to interface with said at least one device; means for determining whether said at least one device is supported by the monitoring system using  
55 configuration information stored in the second database; means for creating a device object using configuration information stored in said first and second databases to establish communication between said at least one device and the monitoring system, wherein the device object includes references to configuration information stored in the first database, the references using vectors or arrays; and means for updating configuration information, for said at least one device,

stored in the first database with configuration information stored in the second database to enable the monitoring system to interface with said at least one device, thereby allowing flexibility in the creation of device objects.

[0019] In another aspect of the present invention there is provided a computer program according to claim 24.

[0020] In yet another aspect of the present invention there is provided a system according claim 25.

5 [0021] An advantage of the present invention includes the ease with which to change the devices that the system supports by modifying the database rather than the system.

[0022] A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference of the following detailed description when considered in connection with the accompanying drawings.

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Figure 1 is a diagram illustrating the network relationship of device 2 and system 8, in an exemplary embodiment of the present invention.

[0025] Figure 2 is an exemplary flowchart illustrating the steps involved to determine if system 8 is configured to interface with device 2;

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Figure 3 is an exemplary flow chart illustrating the steps involved to determine if system 8 is configured to interface with device 2 using the System Configuration Database 6;

-- Figure 4 is an exemplary illustration of a hierarchical approach to determine if device 2 is supported by system 8; Figure 5 illustrates software objects;

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Figure 6 illustrates an exemplary sequence diagram when the system is initialized to obtain information about object identifiers used to identify the manufacturer, model, and unique identifier, and to obtain information about the manufacturers and models supported by the system;

Figure 7 illustrates an exemplary sequence diagram for creating device objects to represent the monitored devices during initialization;

Figure 8 shows the sequence diagram for executing the setAgent() 122 function of VendorModel 118;

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Figure 9 is an exemplary flowchart for the setAgent() function of VendorModel;

Figure 10 exemplifies a sequence diagram when the system obtains information used to obtain the status information for the specific manufacturer and model of the monitored devices;

Figure 11 shows the flowchart for the createDevice() function of DeviceFactory;

Figure 12 shows the sequence diagram for executing the monitorStatus() function;

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Figure 13 shows the sequence diagram for executing the getStatus() 214 function of Device 210;

Figure 14 shows the tables of a database having information about the manufacturers and models supported by the system;

Figure 15 shows an example of the contents in the tables of the database as described in Figure 14; and

— Figure 16 shows the class diagram for the ODBC2 package.

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[0023] Figure 1 is a diagram illustrating the network relationship of device 2 and system 8. Device 2 interfaces with system 8 through network 4. System 8 is coupled to System Configuration Database (SCD) 6 and System Support Database (SSD) 10. Network 4 can be any type of communication structure that allows device 2 and system 8 to exchange data. For example, network 4 could be either a Wide Area Network (WAN), Local Area Network (LAN), or a simple cable physically connecting the device 2 and system 8. It will be appreciated that the present invention is not limiting of the type of networks, and that other networks may be used to enable communication between device 2 and system 8.

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[0024] System Configuration Database 6 includes information of first and second types. The first type of information is configuration or device information, such as, for example, manufacturer name, model name, IP address, company name, contact person's name, and contact person's e-mail address to name a few. The configuration information is used only during the initialization of system 8 in order to determine which devices need to be monitored. The System Configuration Database 6, however, does not include information about what protocol to use to communicate with the device 2. The SCD 6, however, includes information necessary for communication, such as for example, the IP address. Therefore, SCD 6 contains information that is used to determine if system 8 is configured to interface with device 2. The second type of information stored in SCD 6 is status information. Examples of status information include page count, error status, and toner level. Status information is added to the database (SCD 6) after the initialization of the system 8 when the system 8 is monitoring devices connected to the network 4. The System Configuration Database (SCD 6) is not directly dependent on the System Support Database (SSD 10).

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[0025] The SSD 10 includes information about manufacturers and models that are supported by the system 8. Though this system can support all devices irrespective of manufacturer or model, the amount of status information obtained from the device 2 depends upon manufacturers and models that are supported by the SSD 10. If the manufacturer and model are supported by SSD 10, then detailed status information may be obtained from the device 2. Thus, the SSD 10 determines what type of status information is stored in the System Configuration Database (SCD 6).

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[0026] Information from both SCD 6 and SSD 10 are used to create device objects to represent the devices being

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monitored. Although a single device 2 is shown to be connected to the network 4, it will be appreciated that a plurality of devices, that need to be monitored, may be connected to network 4. The device objects allow the system 8 to communicate with the device 2 and determine what information to obtain from the devices.

[0027] Figure 2 is an exemplary flowchart illustrating how it is determined if system 8 is configured to interface with device 2. In block 12, the system 8 or some other device that is part of the network 4 determines if the system 8 is configured to interface with device 2. For example, it is determined whether the system 8 is programmed with software that allows the system 8 to communicate with device 2. In other words, system 8 uses a protocol that is compatible with device 2, such that system 8 and device 2 can exchange data and operate cooperatively. In determining if the system 8 is configured to interface with device 2, the system 8 also obtained configuration information from the device 2 and determines if device 2 is supported by the system 8.

[0028] In block 14, if it is determined that system 8 is configured to interface with device 2, then in block 20, a communication protocol is established between system 8 and device 2, based on information stored in System Support Database 10. In block 22, the System Configuration Database (SCD 6) is updated with the configuration data obtained when determining if the system 8 was configured to interface with the device 2. However, if it is determined that the system 8 is not configured to interface with device 2 in block 14, then the process ends and device 2 will not interface with system 8.

[0029] Figure 3 is an exemplary flow chart illustrating how it is determined if system 8 is configured to interface with device 2 using the System Configuration Database (SCD 6). In block 24, the device 2 is queried using a standard communication protocol to determine its manufacturer, model, and/or the unique identification..

[0030] In block 26, if the manufacturer, model, or unique identification of the device is determined then the process proceeds to block 36, otherwise, the process proceeds to block 28. In block 36, it is determined that the system is configured to interface with the device 2.

[0031] In block 28, the device 2 is queried using data stored in the System Configuration Database 6 to determine the manufacturer, model, and/or unique identification of device 2. In block 34, it is determined if the manufacturer, model, and/or unique identification of the device 2 was identified in block 28. If the determination of block 34 is positive, then it is determined in block 36 that the system is configured to interface with the device 2. If the determination of block 34 is negative, then it is determined in block 38 that the system is not configured to interface with device 2.

[0032] In querying the device 2 for the manufacturer and model information in blocks 24 and 28, the manufacturer and model of the device is checked with the System Support Database 10 to determine if the manufacturer and model is supported by the system 8. However, it does not affect whether or not the system 8 is configured to interface with the device 2.

[0033] The System Support Database 10 is used to determine what status information is to be obtained from the device 2 when it is being monitored by the system 8. A device object for the device 2 includes information from SSD 10 about what status information to obtain. If the manufacturer and model of the device is not supported in the SSD 10, then the device object will obtain status information that is available to all devices connected to the network 4. If the manufacturer is supported in the SSD 10 but the model of the device is not supported, then the device object will obtain status information that is available for all devices of a manufacturer. If the manufacturer and the model are supported, then the device object will obtain status information that is available for all devices of the model.

[0034] Figure 4 is an illustration of a hierarchical approach to determining if device 2 is supported by system 8. In blocks 56 and 58, it is determined if the manufacturer of the device 2 is supported by the system 8. If the manufacturer is not supported, then in block 60 it is determined that the device is to be configured to use a generic protocol. If the manufacturer is supported, then the process proceeds to block 62.

[0035] In blocks 62 and 64, it is determined if the model of device 2 is supported by the system 8. If the model is not supported, then it is determined in block 66 that the device 2 is to be configured using a manufacturer specific protocol. If the model is supported, then it is determined in block 68 that the device 2 is to be configured using a model specific protocol.

[0036] Figure 5 illustrates software objects. The software object Send Interface Manager 70 interfaces directly or indirectly with software objects DataTransfer 74, ODBC-1 72, DeviceFactory 76, VendorModel 78, ODBC-2 84, SNMP 80, and Device 82.

[0037] Table 1 illustrates the functions of the ODBC-1 72.

TABLE 1

5	updateConfig	Before this function is called, the calling function should not replace the manufacturer and model entries if get functions return null string from VendorModel package. This function updates the device information database of the current record in the ODBC. This function is most efficient when the getConfig below is called initially. First, this function checks if IP address is same at the ODBC. If IP addresses are not the same, the record with correct IP address is obtained from the database. Then, the other fields are copied and the record is updated.
10	getConfig	This function obtains a map from ODBC for the device information in a given format. The function returns true if there is data returned, false if there is no more data.
	saveStatus	This function saves the status information into the ODBC. The function returns true when saving is successful, false otherwise.

[0038] Table 2 illustrates the functions of DeviceFactory 76.

TABLE 2

20	createDevice	This function creates the device of the specification in the Device Factory. The function returns a pointer to the created device if the creation is successful, 0 otherwise.
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[0039] Table 3 illustrates the functions of DataTransfer 74.

TABLE 3

25	startSend	This function triggers the Data Transfer to prepare for sending the data specified in the infoType. The function returns the ErrorCode.
	dataSend	This function in the Data Transfer sends the received data to the appropriate destination after properly formatting, encrypting and encoding. The function returns the ErrorCode.
30	endSend	This function in the Data Transfer ends the data sending. The function returns the ErrorCode.

[0040] Table 4 illustrates the functions of Device 82.

TABLE 4

35	getStatus	This function obtains status information from a device. The function returns true when the status is returned, false when status could not be obtained. This function resets the variable that keeps the error status before returning.
40	checkErrorStatus	This function triggers the device to check the error status to be saved internally.

[0041] Table 5 illustrates the functions of ODBC-2 84.

TABLE 5

45	getManufInfo	This function obtains the name of the manufacturer, its vendor OID, the OID where the model information is stored, and the OID where the unique ID can be obtained. This function returns true when the data is returned, false when no more data is available and all the strings are set to null strings.
50	getSupportedModel	This function obtains the Manufacturer and supported model. There may be more than one instances of the same manufacturer, but the model is unique for the given manufacturer. This function returns true when the data is returned, false when no more data is available and all the strings are set to null strings.
55	getManufStatusInfo	This function obtains the infoType and OID associated with the infoType for the given Manufacturer. The obtained infoType and OID pair is supported by all the devices from the given manufacture. This function returns true when the data is returned, false when no more data is available and all the strings are set to null strings.

Table continued

5	getModelStatusInfo	This function obtains the infoType and OID associated with the infoType for the given Manufacturer and model. This function returns true when the data is returned, false when no more data is available and all the strings are set to null strings.
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[0042] Table 6 illustrates the functions of SNMP 80.

TABLE 6

10	setAgent	This function sets the IP address of the device to be contacted.
	getManufacturer	This function gets the manufacturer at the IP address. If the manufacturer is obtained, the function returns true. If the error is detected in the process, the function returns false.
15	getModel	This function gets the model of the device. If the model is obtained, including the null string, the function returns true. If the error is detected in the process, the function returns false.
	getUniqueld	This function returns the unique ID from device. If the unique ID is obtained, including the null string, the function returns true. If the error is detected in the process, the function returns false.

[0043] VendorModel 78 is responsible for obtaining information about the manufacturer and model of the monitored device. This software object obtains the manufacturer, model, and unique identifier of the monitored device. The class CVendorModel of VendorModel 78 uses information from the database to determine the manufacturers and models supported by the system. The class also uses information from the database needed to obtain the model and unique identifier from the monitored device. The public and private functions of CVendorModel are shown in Table 7 below.

TABLE 7

	Function Name	Description
30	Public CVendorModel ()	Constructor
	~ CVendorModel ()	Destructor
	bool setAgent(std::string& in_sIP)	Creates an SNMP session for the monitored device and obtains the manufacturer, model, and unique identifier of the device
35	bool getManufacturer(std::string& out sManufacturer)	Returns the manufacturer of the device
	bool getModel(std::string& out sModel)	Returns the model of the device
	bool getUniqueID(std::string & out_sID)	Returns the unique identifier of the device
40	Private void setVectorAndMapAttributes()	Constructs a vector containing information needed to determine manufacturer, model, and unique identifier of the device and a map containing information about manufacturers and models supported by the system
45	void obtainManufacturer()	Obtains information about the manufacturer from the device
	void obtainModel ()	Obtains information about the model from the device
50	void obtainUniqueID()	Obtains information about the unique identifier from the device
	void convertToAllUpper(std::string& inOut sString)	Converts the input string to all upper case
55	std::string convertToHex(std::string& in sString)	Converts the input string to a hexadecimal string

[0044] Table 8 below shows the attributes of the CVendorModel class that are used in the above functions.

TABLE 8

Type	Attribute Name	Description
CSNMP	m_SNMP	This attribute member is used to implement an SNMP session for the monitored devices.
std::vector<ManufacturerAndModelInfo>	m_ManufacturerAndModelInfoVector	This attribute member is a vector that contains information about the object identifiers used to identify the manufacturer, model, and unique identifier of the monitored devices.
std::map<std::string, std::vector<std::string >>	m_ManufacturerModelMap	This attribute member is a map that lists all the models of a given manufacturer in the vector that the system supports.
std::string	m_sManufacturer	This attribute member represents the Manufacturer of the monitored device.
std::string	m_sModel	This attribute member represents the Model of the monitored device.
std::string	m_sUniqueID	This attribute member represents the unique identifier of the monitored device.
bool	m_bReturn	This attribute is set to true if SNMP session is successful in the setAgent () function; false otherwise.
std::string	m_sCurrentModelOID	This attribute member represents the object identifier used to find information about the model of the monitored device.
std::string	m_sCurrentUniqueOID	This attribute member represents the object identifier used to find information about the unique ID such as a serial number of the monitored device.

[0045] ManufacturerAndModelInfo in m\_ManufacturerAndModelInfoVector has the following structure:

```

struct ManufacturerAndModelInfo{
    std::string m_sManufacturer;
    std::string m_sEnterpriseOID;
    std::string m_sModelOID;
    std::string m_sUniqueOID;
};

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[0046] m\_sManufacturer is the name of the manufacturer. m\_sEnterpriseOID is the enterprise object identifier associated with the manufacturer. The enterprise object identifier is unique to a manufacturer. m\_sModelOID is the object identifier that can be used to find the model name of the device. m\_sUniqueOID is the object identifier that can be used



to find the unique identifier of the device. The unique identifier can be the serial number or the MAC address of the device.

[0047] DeviceFactory 76 is responsible for creating a device object representing the monitored device. DeviceFactory 76 makes sure the device object knows what status information it needs to obtain. CDeviceFactory is the only class in DeviceFactory 76 package. The public and private functions of CDeviceFactory are shown in Table 9 below.

TABLE 9

	Function Name	Description
Public	CDeviceFactory ()	Constructor
	~CDeviceFactory ()	Destructor
	virtual CDevice * createDevice(std::string& in_sIP, CSNMP & in_SNMP, std::string & in_sManufacturer, std::string & in_sModel, std::string & in_sUniqueID)	This function creates a device object representing the monitored device and passes into it a vector containing information about what status information to obtain.
Private	void setGenericDeviceVectorO	This function sets a vector to contain information used to obtain status information that is obtainable from all monitored devices.
	void setManufacturerVectorMap()	This function sets a map to contain information used to obtain status information that is obtainable from all monitored devices of the specific manufacturers.

[0048] Table 10 below shows the attributes of the CDeviceFactory class that are used in the above functions.

TABLE 10

Type	Attribute Name	Description
CSupportODBC	m_SupportODBC	This attribute member represents an object used to access information in the database that is needed to obtain status information of the monitored devices.
std::vector<std::pair<i infoType, std::string> >	m_GenericDeviceVector	This attribute member contains information used to obtain status information for monitored devices of all manufacturer and model.
std::map<std::string, std::vector<std::pair<i infoType, std::string>> >	m_ManufacturerVectorMap	This attribute member contains information used to obtain status information for monitored devices of a given manufacturer.

[0049] infoType is a number used in m\_GenericDeviceVector and m\_ManufacturerVectorMap used to represent a specific type of status information. For example, 503 represents a NoPaper condition for the monitored device and 601 represents the page life count of the monitored device.

[0050] Device 82 represents a monitored device. It accesses status information of the monitored device. Status information includes information such as error status, page count, toner cartridge level, and alerts. CDevice is the only class in Device 82 package. The public functions of CDevice are shown in Table 11 below.

TABLE 11

	Function Name	Description
Public	CDevice (std::string& in_sIPAddress, CSNMP& in_SNMP, std::string& in_sManufacturer, std::string& in_sModel, std::string& in_sUniqueID)	Constructor
	~ CDevice ()	Destructor

Table continued

	Function Name	Description
5	bool getStatus(std::map<infoType, std::string> & out StatusInformation)	This function obtains the status information of the monitored device
	bool checkErrorStatus()	This function gets the error status of the monitored device
10	bool setNumOIDVector (std::vector<std::pair<infoType, std::string> > & in_Vector)	This function sets the vector that will be used to obtain the status information from the monitored device via SNMP.

[0051] Table 12 below shows the attributes of the CDevice class that are used in the above functions.

TABLE 12

Type	Attribute Name	Description
std::string	m_sIPAddress	This attribute member is the IP address of the monitored device
CSNMP &	m_sSNMP	This attribute member is used to implement an SNMP session for the monitored devices.
std::string	m_sManufacturer	This attribute member is the manufacturer of the monitored device.
std::string	m_sModel	This attribute member is the model of the monitored device.
std::string	m_sUniqueID	This attribute member is the unique ID for the monitored device.
char	m_cError	This attribute member is to keep the error bits representing the error status of the monitored device
std::vector<std::pair<infoType, std::string>	m_NumOIDVector	This vector stores information that will be used to obtain the status information from the monitored device via SNMP.

[0052] Figure 6 illustrates an exemplary sequence diagram when the system is initialized to obtain information about the object identifiers used to identify the manufacturer, model, and unique identifier and to obtain information about the manufacturers and models supported by the system. VendorModel 86 interacts with ODBC2 88 to obtain this information. ODBC2 88 provides an interface to the database to obtain information requested of it by VendorModel 86. VendorModel 86 calls the function getManufInfo() 90 of ODBC2 88 to obtain the object identifiers used to identify the manufacturer, model, and unique identifier of the monitored devices from the database. This information is stored in the vector m\_ManufacturerAndModelInfoVector described in Table 8 above. getManufInfo() 90 is called multiple times until all the object identifiers for all manufacturers supported by the system are read in from the database. Then VendorModel 86 calls the function getSupportedModel() 92 of ODBC2 88 to obtain the manufacturer and model supported by the system from the database. This information is stored in the map m\_ManufacturerModelMap described in Table 8 above. getSupportedModel() is called multiple times until all the models supported by the system are read in from the database. To remove, modify, or add the manufacturers and models supported by the system, the only change necessary is in the database which stores information about the supported manufacturers and models. No change needs to be done to the system when the manufacturers and models supported by the system changes. The information is read in from the database during initialization.

[0053] Figure 7 illustrates an exemplary sequence diagram for creating device objects to represent the monitored devices during initialization. Initially, the system 8 (Fig. 1) attempts to establish communication with device 2. If the system 8 cannot be configured to interface with device 2, configuration information, such as manufacturer, model, and a unique identifier from device 2 is obtained. In the process of determining the configuration information, a determination is made to find out if the device 2 is supported by the system 8 using information from System Support Database (SSD

10). A device object is created using information from the SSD 10, thus establishing a communication protocol between the system 8 and the device 2 - irrespective of whether or not the device is supported by the system 8. Subsequently, configuration information for the device 2 is updated in the System Configuration Database (SCD 6). SendInterfaceManager 94 calls getConfig() 102 of ODBC 96. ODBC 96 provides an interface to the database to obtain configuration information of the monitored devices. The configuration information includes manufacturer name, model name, and IP address of the monitored device, the name, phone number, and email address of the contact person who is responsible for the monitored device. The database contains the configuration information of all devices that are to be monitored. However, not all of the devices in this database may be supported by the system as specified in the database associated with ODBC2 84 of Figure 5.

[0054] SendInterfaceManager 94 calls setAgent() 104, creating an SNMP session with the monitored device to obtain the manufacturer, model, and unique identifier of the device. More details of this function are provided in Figure 8. SendInterfaceManager 94 calls getManufacturer() 106, getModel() 108, and getUniqueID() 110 of VendorModel 98 to get the manufacturer name, model name, and unique identifier of the monitored device. SendInterfaceManager 94 calls createDevice() 112 of DeviceFactory 100 to create a device object for the monitored device. The device object will be used by SendInterfaceManager 94 to obtain status information of the monitored device. SendInterfaceManager 94 calls updateConfig() of ODBC 96 to update the configuration information in the database.

[0055] All the steps in the sequence are repeated until all the monitored devices in the database are obtained. A device object will be created for each of the monitored devices. SendInterfaceManager 94 will maintain each of the device objects.

[0056] Figure 8 shows the sequence diagram for executing the setAgent() 122 function of VendorModel 118. SendInterfaceManager 116 calls setAgent() 122 of VendorModel 118. VendorModel 118 calls setAgent() 124 of SNMP 120. This function sets up an SNMP session between the system and the monitored device. VendorModel 118 calls its own function obtainManufacturer() 126 to obtain the manufacturer name of the monitored device. In the function obtainManufacturer() 126, VendorModel 118 calls getNextStringValueForOID() 128 of SNMP 120 to obtain the enterprise object identifier via SNMP from the monitored device. The enterprise object identifier is used to identify the manufacturer of the monitored device. VendorModel 118 calls its own function obtainModel() 130 to obtain the model name of the monitored device. In the function obtainModel() 130, VendorModel 118 calls getNextStringValueForOID() 132 of SNMP 120 to obtain the model name of the monitored device via SNMP. VendorModel 118 calls its own function obtainUniqueID() 134 to obtain the unique identifier of the monitored device. In the function obtainUniqueID() 134, VendorModel 118 calls getNextStringValueForOID() 136 of SNMP 120 to obtain the unique identifier of the monitored device via SNMP.

[0057] Figure 9 is an exemplary flowchart for the setAgent() function of VendorModel. In step 140 the variables representing the manufacturer name, model name, and unique identifier are set to an empty string. These variables are m\_sManufacturer, m\_sModel, and m\_sUniqueID as exemplified in Table 8. In step 142 the enterprise object identifier of the monitored device is obtained via SNMP. In step 144 the enterprise object identifier obtained from the monitored device is compared to those supported by the system. The enterprise object identifier and its corresponding manufacturer supported by the system are stored in the vector m\_ManufacturerAndModelInfoVector as described in Table 8. The vector is searched to determine if the enterprise object identifier of the monitored device is found. If the enterprise object identifier cannot be found in the vector, then step 156 will be processed next. If the enterprise object identifier is found in the vector, then the manufacturer of the monitored device is supported by the system and step 146 is processed next. In step 146 the variable for the manufacturer name m\_sManufacturer is set to the manufacturer name corresponding to the enterprise object identifier in the vector. In step 148 the variables m\_sCurrentModelOID and m\_sCurrentUniqueOID for the object identifier used to find the model name and the unique identifier of the monitored device is set to the object identifiers corresponding to the enterprise object identifier in the vector. In step 150 the model name is obtained from the monitored device via SNMP using the object identifier m\_sCurrentModelOID.

[0058] In step 152 the model name obtained from the monitored device is compared to those supported by the system. The manufacturer and model supported by the system are stored in the map m\_ManufacturerModelMap as described in Table 8. The map is searched to determine if the model is found in the map. If the model cannot be found in the map, then step 156 will be processed next. If the model can be found in the map, then the model of the monitored device is supported by the system and step 154 is processed next. In step 154 the variable for the model name m\_sModel is set to the model name obtained from the monitored device. In step 156 the unique identifier is obtained from the monitored device via SNMP using the object identifier m\_sCurrentUniqueOID. Then set the variable for the unique identifier m\_sUniqueID to the unique identifier obtained from the monitored device.

[0059] The functions setAgent() of VendorModel allows the system to obtain the manufacturer name and model name of the monitored device via SNMP to determine if it is supported by the system. Also, it allows the system to verify the manufacturer name and model name.

[0060] Figure 10 exemplifies a sequence diagram when the system obtains information used to obtain the status information for the specific manufacturer and model of the monitored devices. DeviceFactory 160 interacts with ODBC2 162 to obtain this information. ODBC2 162 provides an interface to the database to obtain information requested of it by DeviceFactory 160. DeviceFactory 160 calls the function getManufStatusInfo() 164 of ODBC2 162 to obtain information

needed to obtain the status information from monitored devices for a specific manufacturer via SNMP. The information includes a number (infoType) representing some type of status information and an object identifier used to obtain the status information via SNMP. getManufStatusInfo() 166 is called multiple times until the information needed to obtain all the status information for a specific manufacturer are read in from the database. Then DeviceFactory 160 calls the function getModelStatusInfo() 168 of ODBC2 162 to obtain information needed to obtain status information from monitored devices for a specific model via SNMP. The information includes a number (infoType) representing some type of status information and an object identifier used to obtain the status information via SNMP. getModelStatusInfo() 170 is called multiple times until the information needed to obtain all the status information for a specific model are read in from the database. This sequence is called within the createDevice() function of DeviceFactory when a device object is created for the monitored device. This information will be added to the device object as described in Figure 11.

[0061] By using the database to store information used to obtain the status information pertaining to the manufacturer and the status information pertaining to the model, status information to be obtained from the monitored devices can be easily modify, remove, or add to the database without any changes to the system.

[0062] Figure 11 shows the flowchart for the createDevice() function of DeviceFactory. In step 174 a device object is created to represent the monitored devices. In step 176 a vector containing information needed to obtain status information from devices of all manufacturers is assigned to a local vector. This vector corresponds to m\_GenericDeviceVector described in Table 10. In step 178 the manufacturer name of the monitored device is checked to see if it is supported by the system (the manufacturer name is an empty string if it is not supported by the system). If the manufacturer name is not supported, then step 186 will be processed next. If the manufacturer name is supported, then step 180 will be processed next.

[0063] In step 180 information needed to obtain status information from the monitored device of a specific manufacturer is obtained from a map and added to the local vector. The map corresponds to m\_ManufacturerVectorMap described in Table 10. In step 182 the model name of the monitored device is checked to see if it is supported by the system (the model name is an empty string if it is not supported by the system). If the model name is not supported, then step 186 will be processed next. If the model name is supported, then step 184 will be processed next.

[0064] In step 184 information needed to obtain status information from the monitored device of a specific model is obtained from the database and added to the local vector. In step 186 the local vector containing the information needed to obtain all the status information of the monitored device is set in the device object. The device object will have information about what status information it must get from the monitored device.

[0065] DeviceFactory creates and initializes all the device objects so that it knows what status information it must obtain.

[0066] Figure 12 shows the sequence diagram for executing the monitorStatus() function. The process sends the status information of the monitored devices to a desired location. SendInterfaceManager 190 calls startSend() 198 of DataTransfer 196 to prepare the system to send the status information of the monitored devices via email (SMTP). SendInterfaceManager 190 calls getStatus() 200 of Device 194 to obtain the status information of the monitored device. Device 194 corresponds to the monitored device and it knows what status information it must obtain. SendInterfaceManager 190 calls saveStatus() 202 of ODBC 192 to store the status information of the monitored device in the database. SendInterfaceManager 190 calls dataSend() 204 of DataTransfer 196 to send the status information of the monitored device via email (SMTP). The steps of calling getStatus() 200, saveStatus() 202, and dataSend() 204 are repeated for each monitored device. There is a device object for each monitored device. SendInterfaceManager 190 calls endSend() 206 of DataTransfer 196 to complete the sending of the status information via email.

[0067] Figure 13 shows the sequence diagram for executing the getStatus() 214 function of Device 210. SendInterfaceManager 208 calls getStatus() 214 of Device 210 to obtain the status information of the monitored device. Device 210 represents a monitored device of a specific manufacturer and model. The status information will be obtained from the monitored devices via SNMP. If the monitored device is not supported by the system, then the status information obtained from the monitored device is the status information obtainable for all monitored devices (all-system status information) such as error status. If the manufacturer but not the model of the monitored device is supported by the system, then the status information obtained from the monitored device is the all-system status information and the status information obtainable for all monitored devices of the specific manufacturer (manufacturer-specific status information). If the manufacturer and model of the monitored device is supported by the system, then the status information obtained from the monitored device is the all-system status information, the manufacturer-specific status information, and the status information obtainable for all monitored devices of the specific model (model-specific status information). Device 210 contains a vector so that it knows which information it needs to obtain. Device 210 calls getNextStringValueForOID() of Snmp 212 so the system can obtain the status information from the monitored device via SNMP. getNextStringValueForOID() 218 is called multiple times to obtain all the status information from the monitored device.

[0068] Figure 14 shows the tables of a database that contains information about the manufacturers and models supported by the system. The table also includes information about what information is to be obtained for each manufacturer and model. Manufacturer 230 is the table that contains information about the manufacturers supported by the system. Manufacturer 230 also contains the following information- enterprise object identifier for the manufacturer, object

identifier used to find the model name of the monitored device, and object identifier used to find the unique identifier of the monitored device. SupportedModelByManufacturer 220 is the table that contains the models with its corresponding manufacturer that are supported by the system. To add or remove manufacturers and models supported by the system, only the tables Manufacturer 230 and SupportedModelByManufacturer 220 need to be modified. No modification needs to be made to the code of the system. The system will read the information from these tables of the database.

[0069] ComManufStatus 226 is the table that contains information about what information will be obtained from the monitored device based on its manufacturer name. The table contains the manufacturer name and a number representing the type of information. ModelStatus 222 is the table that contains information about what information will be obtained from the monitored device based on its model name. The table contains the manufacturer name, the model name, and a number representing the type of information. To add or remove information to be obtained from the monitored device, only the tables ComManufStatus 226 and ModelStatus 222 need to be modified. No modification needs to be made to the code of the system. The system will read the information from these tables of the database.

[0070] EnumOID 224 is the table that contains information about the object identifier used to find the information corresponding to the number. The object identifier will be used by the system to find a specific type of information from the monitored device via SNMP. EnumCorrespondence 228 is the table that contains a description of the numbers used to represent a type of information. This table is not used by the system but will provide the user of the system information about what the numbers represent.

[0071] Figure 15 shows an example of the contents in the tables of the database as described in Figure 14. Microsoft Access is the database used to store information about the manufacturers and models supported by the system.

[0072] Figure 16 shows the class diagram for the ODBC2 package. The CSupportODBC 232 class is the interface for this package to access information in the database. The CManufacturerData 240 class accesses information from the database needed to obtain the manufacturer, model, and unique ID of the monitored device. The CSupportedModelData 234 class accesses information from the database about the manufacturer and model of monitored device supported by the system. The CComManufStatusData 236 class accesses information from the database needed to obtain manufacturer status information associated with the monitored device. The CModelStatusData 238 class accesses information from the database needed to obtain model status information associated with the monitored device. The CManufacturerDatabase 242 class provides an interface to the table in the database that contains the manufacturer information. The CSupportedModelDatabase 244 class provides an interface to the table in the database that contains information about supported models. The CComManuStatusDatabase 246 class provides an interface to the table in the database that contains the manufacturer status information. The CModelStatusDatabase 250 class provides an interface to the table in the database that contains the model status information. The CInfoTypeOIDDatabase 248 class provides an interface to the table in the database that contains the correspondence between the infoType enumeration and the object identifier.

[0073] CManufacturerDatabase 242, CSupportedModelDatabase 244, CComManufStatusDatabase 246, CModelStatusDatabase 250, and CInfoTypeOIDDatabase 248 are all classes derived from CRecordset 252 of the Microsoft Foundation Class (MFC) library.

[0074] The foregoing description of the preferred embodiment of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. For example, any one or more of the concepts described or shown herein may be applied to the system and/or method disclosed in US Patent Application Publication No. 20020152292 (Serial No. 09/756,120), filed January 9, 2001, entitled "Method and System of Remote Support of Device Using Email." Moreover, any concept or feature described in US Patent Application No. 09/756,120 may be applied to the systems or methods disclosed herein. The embodiments were chosen and described to best explain the principles of the invention and its practical applications thereby enable others skilled in the art to utilize the invention. It is intended that the scope of the present invention be defined only by the claims appended hereto.

## Claims

1. A method of establishing a connection between at least one device and a monitoring system (8), said at least one device (2) and said monitoring system (8) being communicatively coupled via a network (4), the monitoring system (8) being communicatively coupled to first (6) and second (10) databases, the method comprising the steps of:
  - a) determining if the monitoring system (8) is configured to interface with said at least one device (2);
  - b) obtaining configuration information from said at least one device (2) if the monitoring system (8) is not configured to interface with said at least one device (2);
  - c) determining if said at least one device (2) is supported by the monitoring system (8) using information stored in the second (10) database;

- d) creating a device object using information stored in said first (6) and second (10) databases to establish communication between said at least one device (2) and the monitoring system (8), wherein the device object includes references to configuration information stored in the first database (6), the references using vectors or arrays; and
- 5 e) updating configuration information, for said at least one device (2), stored in the first database (6) with configuration information stored in the second database (10) to enable the monitoring system (8) to interface with said at least one device (2), thereby allowing flexibility in the creation of device objects.
- 10 2. The method of claim 1, wherein the step of obtaining configuration information from said at least one device (2) includes identifying at least one of: i) manufacturer of the device (2), ii) model of the device (2), and iii) unique identifier of said at least one device (2).
3. The method as in claim 2, wherein the configuration information is only used during initialization of the monitoring system to identify if at least one device (2) requires monitoring.
- 15 4. The method of claim 1, 2 or 3, wherein the step of determining if the monitoring system (8) is configured to interface with said at least one device (2) includes querying the first database (6) with at least one of manufacturer, model, and unique identifier of said at least one device (2).
- 20 5. The method of claim 1, 2, 3 or 4, wherein the step of determining if the monitoring system (8) is configured to interface with said at least one device (2) comprises querying said at least one device (2) with data stored in the first database (6).
- 25 6. The method as in claim 5, wherein the first database (6) is a system configuration database and comprises:  
configuration information for enabling communication between the monitoring system and said at least one device (2); and  
status information related to said at least one device (2), the status information being added after initialization of the monitoring system (8) for monitoring said at least one device (2).
- 30 7. The method as in any one of the preceding claims, wherein the second database (10) is a system support database and comprises information about various manufacturers and device models supported by the monitoring system (8).
- 35 8. The method as in any one of the preceding claims, wherein the step of determining if said at least one device is supported by the monitoring system (8) further comprises obtaining detailed status information of said at least one device (2) being monitored if the manufacturer and model of said at least one device (2) are supported by the monitoring system (8).
- 40 9. The method as in any one of the preceding claims, wherein the device object allows the monitoring system (8) to communicate with said at least one device (2) and determine configuration information needed from said at least one device (2).
- 45 10. The method as in any one of the preceding claims, wherein the device object storing references to configuration information includes object identifiers.
11. The method of any one of the preceding claims, wherein said at least one device (2) includes hardware components.
12. The method of any one of the preceding claims, wherein said at least one device (2) includes software components.
- 50 13. An apparatus adapted to establish a connection to at least one device (2) communicatively coupled via a network based system, the apparatus comprising:  
a monitoring system (8) communicatively coupled to the network;  
first (6) and second (10) databases communicatively coupled to the monitoring system (8);  
55 means for determining if the monitoring system is configured to interface with the at least one device (2);  
means for obtaining configuration information from said at least one device (2) if the monitoring system (8) is not configured to interface with said at least one device;  
— means for determining whether said at least one device (2) is supported by the monitoring system (8) using

configuration information stored in the second database (10);  
 means for creating a device object using configuration information stored in said first (6) and second (10) databases to establish communication between said at least one device (2) and the monitoring system (8), wherein the device object includes references to configuration information stored in the first database (6), the references using vectors or arrays; and  
 means for updating configuration information, for said at least one device (2), stored in the first database (6) with configuration information stored in the second database (10) to enable the monitoring system to interface with said at least one device, thereby allowing flexibility in the creation of device objects.

14. The apparatus as in claim 13, wherein configuration information includes information related to: i) manufacturer, ii) model, and iii) unique identifier of said at least one device (2).

15. The apparatus as in claim 14, wherein the configuration information is only used during initialization of the monitoring system (8) to identify at least one device (2) that requires monitoring.

16. The apparatus as in claim 13, 14 or 15, further comprising:

means for querying the first database (6) with at least one of manufacturer, model, and unique identifier of said at least one device (2) to determine if the monitoring system (8) is configured to interface with said at least one device (2).

17. The apparatus as in claim 13, 14, 15 or 16, further comprising:

means for querying said at least one device (2) with data stored in the first database (6) to determine if the monitoring system (8) is configured to interface with said at least one device (2).

18. The apparatus of any one of claims 13 to 17, wherein the first database (6) is a system configuration database and comprises:

configuration information for enabling communication between the monitoring system and said at least one device (2); and  
 status information related to said at least one device (2), the status information being added after initialization of the monitoring system for monitoring said at least one device (2).

19. The apparatus of any one of claims 13 to 18, wherein the second database (10) is a system support database and comprises information about various manufacturers and device models supported by the monitoring system (8).

20. The apparatus of any one of claims 13 to 19, wherein the device object allows the monitoring system (8) to communicate with said at least one device (2) and determine configuration information needed from said at least one device (2).

21. The apparatus of any one of claims 13 to 20, wherein the device object storing references to configuration information includes object identifiers.

22. The apparatus as in any one of claims 13 to 20, wherein said at least one device (2) includes hardware components.

23. The apparatus as in any one of claims 13 to 22, wherein said at least one device (2) includes software components.

24. A computer program comprising program code means that, when executed on a computer system, instruct the computer system to perform the method of any one of claims 1 to 12.

25. A system having at least one network (4) connected device (2), the system comprising:

a controller (8) for monitoring the at least one network connected device, said controller having logic for:

determining if the controller (8) is configured to interface with said at least one network connected device (2);  
 obtaining configuration information from said at least one network connected device (2) if the controller (8) is not configured to interface with said at least one network connected device (2);

first (6) and second (10) databases communicatively coupled to the controller (8), said second database (10) storing configuration information for determining if said at least one network connected device (2) is supported by the controller (8), said first (6) and second (10) databases having configuration information for creating a device object to establish communication between said at least one network connected device (2) and the controller (8), wherein the device object includes references to configuration information stored in the first database, the references using vectors or arrays; and wherein configuration information in said first database (6) is updated with configuration information stored in the second database (10) for enabling the controller to interface with said at least one network connected device (2), thereby allowing flexibility in the creation of device objects.

## Revendications

1. Procédé d'établissement d'une connexion entre au moins un dispositif et un système de surveillance (8), ledit au moins un dispositif (2) et ledit système de surveillance (8) étant couplés de façon communicative via un réseau (4), le système de surveillance (8) étant couplé de façon communicative à des première (6) et seconde (10.) bases de données; le procédé comprenant les étapes de :

- a) détermination de si le système de surveillance (8) est configuré pour s'interfacer avec ledit au moins un dispositif (2) ;
- b) obtention d'informations de configuration à partir dudit au moins un dispositif (2) si le système de surveillance (8) n'est pas configuré pour s'interfacer avec ledit au moins un dispositif (2) ;
- c) détermination de si ledit au moins un dispositif (2) est supporté par le système de surveillance (8) utilisant des informations stockées dans la seconde base de données (10) ;
- d) création d'un objet de dispositif utilisant des informations stockées dans lesdites première (6) et seconde (10) bases de données pour établir une communication entre ledit au moins un dispositif (2) et le système de surveillance (8), dans lequel l'objet de dispositif comprend des références à des informations de configuration stockées dans ladite première base de données (6), les références utilisant des vecteurs ou des réseaux ;
- e) mise à jour d'informations de configuration, pour ledit au moins un dispositif (2), stockées dans la première base de données (6) avec des informations de configuration stockées dans ladite seconde base de données (10) pour permettre au système de surveillance (8) de s'interfacer avec ledit au moins un dispositif (2), permettant ainsi une souplesse dans la création des objets de dispositif.

2. Procédé selon la revendication 1, dans lequel l'étape d'obtention des informations de configuration à partir dudit au moins un dispositif (2) comprend l'identification d'au moins un de : i) fabricant de dispositif (2), ii) modèle du dispositif (2), et iii) identifieur unique dudit au moins un dispositif (2).

3. Procédé selon la revendication 2, dans lequel les informations de configuration sont seulement utilisées pendant l'initialisation du système de surveillance pour identifier si au moins un dispositif (2) nécessite la surveillance.

4. Procédé selon la revendication 1, 2 ou 3, dans lequel l'étape de détermination de si le système de surveillance (8) est configuré pour s'interfacer avec ledit au moins un dispositif (2) comprend l'interrogation de la première base de données (6) avec au moins un du fabricant, du modèle, et de l'identifieur unique dudit au moins un dispositif (2).

5. Procédé selon la revendication 1, 2, 3 ou 4, dans lequel l'étape de détermination de si le système de surveillance (8) est configuré pour s'interfacer avec ledit au moins un dispositif (2) comprend l'interrogation dudit au moins un dispositif (2) avec des données stockées dans la première base de données (6).

6. Procédé selon la revendication 5, dans lequel la première base de données (6) est une base de données de configuration de système et comprend :

- des informations de configuration pour permettre une communication entre le système de surveillance et ledit au moins un dispositif (2) ; et
- des informations d'état liées audit au moins un dispositif (2), les informations d'état étant ajoutées après l'initialisation du système de surveillance (8) pour surveiller ledit au moins un dispositif (2).

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel la seconde base de données (10) est une base de données de support de système et comprend des informations concernant divers fabricants et



modèles de dispositif supportés par le système de surveillance (8).

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'étape de détermination de si ledit au moins un dispositif est supporté par le système de surveillance (8) comprend en outre l'obtention des informations d'état détaillées dudit au moins un dispositif (2) étant surveillé si le fabricant et le modèle dudit au moins un dispositif (2) sont supportés par le système de surveillance (8).
9. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'objet de dispositif permet au système de surveillance (8) de communiquer avec ledit au moins un dispositif (2) et de déterminer des informations de configuration nécessaires à partir dudit au moins un dispositif (2).
10. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'objet de dispositif stockant des références à des informations de configuration comprend des identifiants d'objet.
11. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit au moins un dispositif (2) comprend des composants matériels.
12. Procédé selon l'une quelconque des revendications précédentes, dans lequel ledit au moins un dispositif (2) comprend des composants logiciels.
13. Appareil adapté pour établir une connexion à au moins un dispositif (2) couplé de façon communicative via un système de base de réseau, l'appareil comprenant :
  - un système de surveillance (8) couplé de façon communicative au réseau ;
  - des première (6) et seconde (10) bases de données couplées de façon communicative au système de surveillance (8) ;
  - un moyen pour déterminer si le système de surveillance est configuré pour s'interfacer avec ledit au moins un dispositif (2) ;
  - un moyen pour obtenir des informations de configuration à partir dudit au moins un dispositif (2) si le système de surveillance (8) n'est pas configuré pour s'interfacer avec ledit au moins un dispositif ;
  - un moyen pour déterminer si ledit au moins un dispositif (2) est supporté par le système de surveillance (8) utilisant des informations de configuration stockées dans la seconde base de données (10) ;
  - un moyen pour créer un objet de dispositif utilisant des informations de configuration stockées dans lesdites première (6) et seconde (10) bases de données pour établir une communication entre ledit au moins un dispositif (2) et le système de surveillance (8), dans lequel l'objet de dispositif comprend des références à des informations de configuration stockées dans ladite première base de données (6), les références utilisant des vecteurs ou des réseaux ; et
  - un moyen pour mettre à jour des informations de configuration, pour ledit au moins un dispositif (2), stockées dans la première base de données (6) avec des informations de configuration stockées dans la seconde base de données (10) pour permettre au système de surveillance de s'interfacer avec ledit au moins un dispositif, permettant ainsi une souplesse dans la création d'objets de dispositif.
14. Appareil selon la revendication 13, dans lequel les informations de configuration comprennent des informations liées à : i) un fabricant, ii) un modèle, et iii) un identifiant unique dudit au moins un dispositif (2)
15. Appareil selon la revendication 14, dans lequel les informations de configuration sont seulement utilisées pendant l'initialisation du système de surveillance (8) pour identifier au moins un dispositif (2) qui nécessite une surveillance.
16. Appareil selon la revendication 13, 14 ou 15, comprenant en outre :
  - un moyen pour interroger la première base de données (6) avec au moins un du fabricant, du modèle, et de l'identifiant unique dudit au moins un dispositif (2) pour déterminer si le système de surveillance (8) est configuré pour s'interfacer avec ledit au moins un dispositif (2).
17. Appareil selon la revendication 13, 14, 15 ou 16, comprenant en outre :
  - un moyen pour interroger ledit au moins un dispositif (2) avec des données stockées dans la première base de données (6) pour déterminer si le système de surveillance (8) est configuré pour s'interfacer avec ledit au moins

un dispositif (2).

18. Appareil selon l'une quelconque des revendications 13 à 17, dans lequel la première base de données (6) est une base de données de configuration de système et comprend :

des informations de configuration pour permettre une communication entre le système de surveillance et ledit au moins un dispositif (2) ; et  
des informations d'état liées audit au moins un dispositif (2), les informations d'état étant ajoutées après l'initialisation du système de surveillance pour surveiller ledit au moins un dispositif (2).

19. Appareil selon l'une quelconque des revendications 13 à 18, dans lequel ladite seconde base de données (10) est une base de données de support de système et comprend des informations concernant divers fabricants et modèles de dispositif supportés par le système de surveillance (8).

20. Appareil selon l'une quelconque des revendications 13 à 19, dans lequel l'objet de dispositif permet au système de surveillance (8) de communiquer avec ledit au moins un dispositif (2) et de déterminer des informations de configuration nécessaires à partir dudit au moins un dispositif (2).

21. Appareil selon l'une quelconque des revendications 13 à 20, dans lequel l'objet de dispositif stockant des références à des informations de configuration comprend des identificateurs d'objet.

22. Appareil selon l'une quelconque des revendications 13 à 20, dans lequel ledit au moins un dispositif (2) comprend des composants matériels.

23. Appareil selon l'une quelconque des revendications 13 à 22, dans lequel ledit au moins un dispositif (2) comprend des composants logiciels.

24. Programme d'ordinateur comprenant un moyen de code de programme qui, lorsqu'il est exécuté sur un système d'ordinateur, donne l'instruction au système d'ordinateur de réaliser le procédé d'une quelconque des revendications 1 à 12.

25. Système ayant au moins un dispositif (2) raccordé au réseau (4), le système comprenant :

un dispositif de commande (8) pour surveiller ledit au moins un dispositif raccordé au réseau, ledit dispositif de commande ayant une logique pour :

déterminer si le dispositif de commande (8) est configuré pour s'interfacer avec ledit au moins un dispositif raccordé au réseau (2) ;

obtenir des informations de configuration à partir dudit au moins un dispositif raccordé au réseau (2) si le dispositif de commande (8) n'est pas configuré pour s'interfacer avec ledit au moins un dispositif raccordé au réseau (2) ;

des première (6) et seconde (10) bases de données couplées de façon communicative au dispositif de commande (8), ladite seconde base de données (10) stockant des informations de configuration pour déterminer si ledit au moins un dispositif raccordé au réseau (2) est supporté par le dispositif de commande (8), lesdites première (6) et seconde (10) bases de données ayant des informations de configuration pour créer un objet de dispositif pour établir une communication entre ledit au moins un dispositif raccordé au réseau (2) et le dispositif de commande (8), dans lequel l'objet de dispositif comprend des références à des informations de configuration stockées dans la première base de données, les références utilisant des vecteurs ou des réseaux ; et

dans lequel les informations de configuration dans ladite première base de données (6) sont mises à jour avec des informations de configuration stockées dans la seconde base de données (10) pour permettre au dispositif de commande de s'interfacer avec ledit au moins un dispositif raccordé au réseau (2), permettant ainsi une souplesse dans la création des objets de dispositif.

## Patentansprüche

1. Verfahren zum Aufbauen einer Verbindung zwischen wenigstens einer Vorrichtung und einem Überwachungssystem

(8), wobei die wenigstens eine Vorrichtung (2) und das Überwachungssystem (8) über ein Netz (4) kommunikationsfähig gekoppelt sind, wobei das Überwachungssystem (8) mit einer ersten Datenbank (6) und mit einer zweiten Datenbank (10) kommunikationsfähig gekoppelt ist, wobei das Verfahren die folgenden Schritte umfasst:

- 5 a) Feststellen, ob das Überwachungssystem (8) so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet;
- b) Erhalten von Konfigurationsinformationen von der wenigstens einen Vorrichtung (2), falls das Überwachungssystem (8) nicht so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet;
- 10 c) Feststellen, ob die wenigstens eine Vorrichtung (2) durch das Überwachungssystem (8) unter Verwendung von in der zweiten Datenbank (10) gespeicherten Informationen unterstützt wird;
- d) Erzeugen eines Vorrichtungsobjekts unter Verwendung von in der ersten Datenbank (6) und in der zweiten Datenbank (10) gespeicherten Informationen, um eine Kommunikation zwischen der wenigstens einen Vorrichtung (2) und dem Überwachungssystem (8) aufzubauen, wobei das Vorrichtungsobjekt Bezugnahmen auf Konfigurationsinformationen enthält, die in der ersten Datenbank (6) gespeichert sind, wobei die Bezugnahmen Vektoren oder Matrizen verwenden; und
- 15 e) Aktualisieren von in der ersten Datenbank (2) gespeicherten Konfigurationsinformationen für die wenigstens eine Vorrichtung (2) mit in der zweiten Datenbank (10) gespeicherten Konfigurationsinformationen, damit das Überwachungssystem (8) mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bilden kann, wodurch eine Flexibilität bei der Erzeugung von Vorrichtungsobjekten ermöglicht wird.
- 20 2. Verfahren nach Anspruch 1, bei dem der Schritt des Erhaltens von Konfigurationsinformationen von der wenigstens einen Vorrichtung (2) das Identifizieren wenigstens eines der folgenden umfasst: i) Hersteller der Vorrichtung (2), ii) Modell der Vorrichtung (2) und iii) eindeutige Kennung der wenigstens einen Vorrichtung (2).
- 25 3. Verfahren nach Anspruch 2, bei dem die Konfigurationsinformationen nur während der Initialisierung des Überwachungssystems verwendet werden, um festzustellen, ob wenigstens eine Vorrichtung (2) eine Überwachung erfordert.
- 30 4. Verfahren nach Anspruch 1, 2 oder 3, bei dem der Schritt des Feststellens, ob das Überwachungssystem (8) so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet, das Abfragen der ersten Datenbank (6) mit dem Hersteller und/oder dem Modell und/oder der eindeutigen Kennung der wenigstens einen Vorrichtung (2) umfasst.
- 35 5. Verfahren nach Anspruch 1, 2, 3 oder 4, bei dem der Schritt des Feststellens, ob das Überwachungssystem (8) so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet, das Abfragen der wenigstens einen Vorrichtung (2) mit in der ersten Datenbank (6) gespeicherten Daten umfasst.
- 40 6. Verfahren nach Anspruch 5, bei dem die erste Datenbank (6) eine Systemkonfigurationsdatenbank ist und umfasst: Konfigurationsinformationen, die eine Kommunikation zwischen dem Überwachungssystem und der wenigstens einen Vorrichtung (2) ermöglichen; und Statusinformationen, die auf die wenigstens eine Vorrichtung (2) bezogen sind, wobei die Statusinformationen nach der Initialisierung des Überwachungssystems (8) hinzugefügt werden, um die wenigstens eine Vorrichtung (2) zu überwachen.
- 45 7. Verfahren nach einem der vorhergehenden Ansprüche, bei dem die zweite Datenbank (10) eine Systemunterstützungsdatenbank ist und Informationen über verschiedene Hersteller und Vorrichtungsmodelle, die durch das Überwachungssystem (8) unterstützt werden, enthält.
- 50 8. Verfahren nach einem der vorhergehenden Ansprüche, bei dem der Schritt des Feststellens, ob die wenigstens eine Vorrichtung durch das Überwachungssystem (8) unterstützt wird, ferner das Erhalten detaillierter Statusinformationen der wenigstens einen überwachten Vorrichtung (2) umfasst, falls der Hersteller und das Modell der wenigstens einen Vorrichtung (2) durch das Überwachungssystem (8) unterstützt werden.
- 55 9. Verfahren nach einem der vorhergehenden Ansprüche, bei dem das Vorrichtungsobjekt dem Überwachungssystem (8) ermöglicht, mit der wenigstens einen Vorrichtung (2) zu kommunizieren und Konfigurationsinformationen, die von der wenigstens einen Vorrichtung (2) benötigt werden, zu bestimmen.

10. Verfahren nach einem der vorhergehenden Ansprüche, bei dem das Vorrichtungsobjekt, das Bezugnahmen für Konfigurationsinformationen speichert, Objektkennungen enthält.
- 5 11. Verfahren nach einem der vorhergehenden Ansprüche, bei der die wenigstens eine Vorrichtung (2) Hardware-Komponenten enthält.
12. Verfahren nach einem der vorhergehenden Ansprüche, bei dem die wenigstens eine Vorrichtung (2) Software-Komponenten enthält.
- 10 13. Vorrichtung, die so beschaffen ist, dass sie eine Verbindung mit wenigstens einer Vorrichtung (2) aufbaut, die über ein netzbasiertes System kommunikationsfähig gekoppelt ist, wobei die Vorrichtung umfasst:
  - ein Überwachungssystem (8), das mit dem Netz kommunikationsfähig gekoppelt ist;
  - 15 eine erste Datenbank (6) und eine zweite Datenbank (10), die mit dem Überwachungssystem (8) kommunikationsfähig gekoppelt sind;
  - Mittel, um festzustellen, ob das Überwachungssystem so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet;
  - Mittel, um Konfigurationsinformationen von der wenigstens einen Vorrichtung (2) zu erhalten, falls das Überwachungssystem (8) nicht so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung eine Schnittstelle bildet;
  - 20 Mittel, um festzustellen, ob die wenigstens eine Vorrichtung (2) durch das Überwachungssystem (8) unterstützt wird, unter Verwendung von in der zweiten Datenbank (10) gespeicherten Konfigurationsinformationen;
  - Mittel, um unter Verwendung von Konfigurationsinformationen, die in der ersten Datenbank (6) und in der zweiten Datenbank (10) gespeichert sind, ein Vorrichtungsobjekt zu erzeugen, um eine Kommunikation zwischen der wenigstens einen Vorrichtung (2) und dem Überwachungssystem (8) aufzubauen, wobei das Vorrichtungsobjekt Bezugnahmen für Konfigurationsinformationen, die in der Datenbank (6) gespeichert sind, enthält, wobei die Bezugnahmen Vektoren oder Matrizen verwenden; und
  - 25 Mittel, um in der ersten Datenbank (6) gespeicherte Konfigurationsinformationen für die wenigstens eine Vorrichtung (2) mit in der zweiten Datenbank (10) gespeicherten Konfigurationsinformationen zu aktualisieren, damit das Überwachungssystem mit der wenigstens einen Vorrichtung eine Schnittstelle bilden kann, wodurch eine Flexibilität bei der Erzeugung von Vorrichtungsobjekten ermöglicht wird.
  - 30
14. Vorrichtung nach Anspruch 13, bei der die Konfigurationsinformationen Informationen enthalten, die bezogen sind auf: i) Hersteller, ii) Modell und iii) eindeutige Kennung der wenigstens einen Vorrichtung (2).
- 35 15. Vorrichtung nach Anspruch 14, bei der die Konfigurationsinformationen nur während der Initialisierung des Überwachungssystems (8) verwendet werden, um wenigstens eine Vorrichtung (2), die eine Überwachung erfordert, zu identifizieren.
- 40 16. Vorrichtung nach Anspruch 13, 14 oder 15, die ferner umfasst:
  - Mittel, um die erste Datenbank (6) mit dem Hersteller und/oder dem Modell und/oder der eindeutigen Kennung der wenigstens einen Vorrichtung (2) abzufragen, um festzustellen, ob das Überwachungssystem (8) so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet.
  - 45
17. Vorrichtung nach Anspruch 13, 14, 15 oder 16, die ferner umfasst:
  - Mittel, um die wenigstens eine Vorrichtung (2) mit in der ersten Datenbank (6) gespeicherten Daten abzufragen, um festzustellen, ob das Überwachungssystem (8) so konfiguriert ist, dass es mit der wenigstens einen Vorrichtung (2) eine Schnittstelle bildet.
  - 50
18. Vorrichtung nach einem der Ansprüche 13 bis 17, bei der die erste Datenbank (6) eine Systemkonfigurationsdatenbank ist und umfasst:
  - 55 Konfigurationsinformationen, die eine Kommunikation zwischen dem Überwachungssystem und der wenigstens einen Vorrichtung (2) ermöglichen; und
  - Statusinformationen, die auf die wenigstens eine Vorrichtung (2) bezogen sind, wobei die Statusinformationen nach der Initialisierung des Überwachungssystems hinzugefügt werden, um die wenigstens eine Vorrichtung

(2) zu überwachen.

- 5 19. Vorrichtung nach einem der Ansprüche 13 bis 18, bei der die zweite Datenbank (10) eine Systemunterstützungsdatenbank ist und Informationen über verschiedene Hersteller und Vorrichtungsmodelle, die durch das Überwachungssystem (8) unterstützt werden, enthält.
- 10 20. Vorrichtung nach einem der Ansprüche 13 bis 19, bei der das Vorrichtungsobjekt dem Überwachungssystem (8) ermöglicht, mit der wenigstens einen Vorrichtung (2) zu kommunizieren und Konfigurationsinformationen zu bestimmen, die von der wenigstens einen Vorrichtung (2) benötigt werden.
21. Vorrichtung nach einem der Ansprüche 13 bis 20, bei der das Vorrichtungsobjekt, das Bezugnahmen für Konfigurationsinformationen speichert, Objektkennungen enthält.
- 15 22. Vorrichtung nach einem der Ansprüche 13 bis 20, bei der die wenigstens eine Vorrichtung (2) Hardware-Komponenten enthält.
23. Vorrichtung nach einem der Ansprüche 13 bis 22, bei der die wenigstens eine Vorrichtung (2) Software-Komponenten enthält.
- 20 24. Computerprogramm, das Programmcodemittel enthält, die, wenn sie auf einem Computersystem ausgeführt werden, das Computersystem anweisen, das Verfahren nach einem der Ansprüche 1 bis 12 auszuführen.
- 25 25. System, das wenigstens eine mit einem Netz (4) verbundene Vorrichtung (2) besitzt, wobei das System umfasst:  
eine Steuereinheit (8), um die wenigstens eine mit dem Netz verbundene Vorrichtung zu überwachen, wobei die Steuereinheit eine Logik aufweist, um:  
festzustellen, ob die Steuereinheit (8) so konfiguriert ist, dass sie mit der wenigstens einen über das Netz verbundenen Vorrichtung (2) eine Schnittstelle bildet; und um  
30 Konfigurationsinformationen von der wenigstens einen über das Netz verbundenen Vorrichtung (2) zu erhalten, falls die Steuereinheit (8) nicht so konfiguriert ist, dass sie mit der wenigstens einen mit dem Netz verbundenen Vorrichtung (2) eine Schnittstelle bildet;  
eine erste Datenbank (6) und eine zweite Datenbank (10), die mit der Steuereinheit (8) kommunikationsfähig gekoppelt sind, wobei die zweite Datenbank (10) Konfigurationsinformationen speichert, um festzustellen,  
35 ob die wenigstens eine mit dem Netz verbundene Vorrichtung (2) durch die Steuereinheit (8) unterstützt wird, wobei die erste Datenbank (6) und die zweite Datenbank (10) Konfigurationsinformationen besitzen, um ein Vorrichtungsobjekt zu erzeugen um eine Kommunikation zwischen der wenigstens einen mit dem Netz verbundenen Vorrichtung (2) und der Steuereinheit (8) aufzubauen, wobei das Vorrichtungsobjekt Bezugnahmen für in der ersten Datenbank gespeicherte Konfigurationsinformationen enthält, wobei die  
40 Bezugnahmen Vektoren oder Matrizen verwenden; und  
wobei die Konfigurationsinformationen in der ersten Datenbank (6) mit in der zweiten Datenbank (10) gespeicherten Konfigurationsinformationen aktualisiert werden, damit die Steuereinheit mit der wenigstens einen mit dem Netz verbundenen Vorrichtung (2) eine Schnittstelle bilden kann, wodurch eine Flexibilität bei der Erzeugung  
45 von Vorrichtungsobjekten ermöglicht wird.

50

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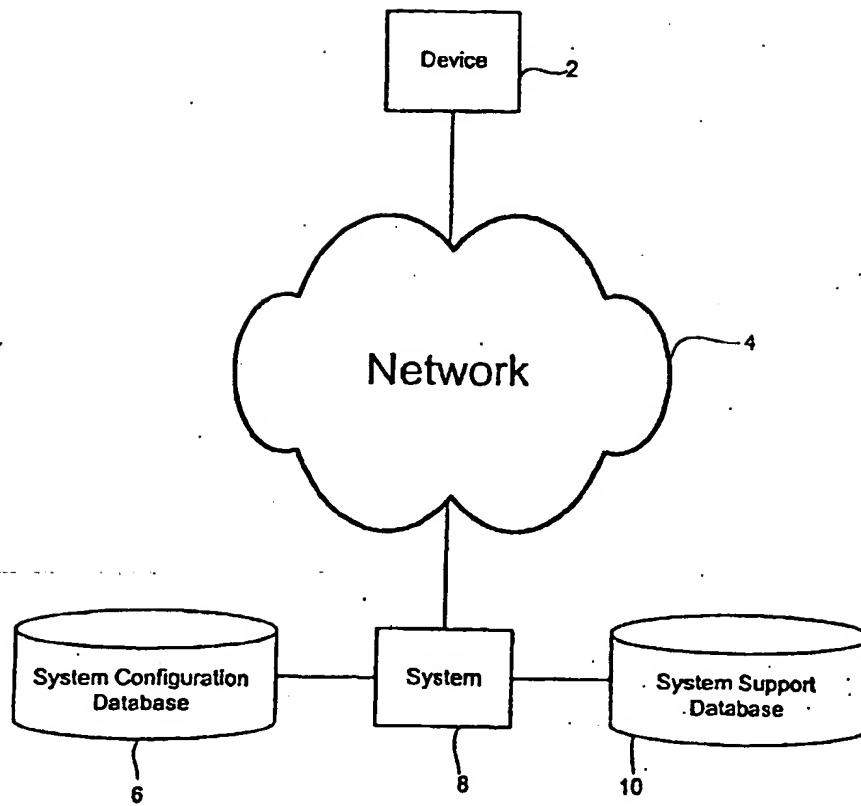


Figure 1

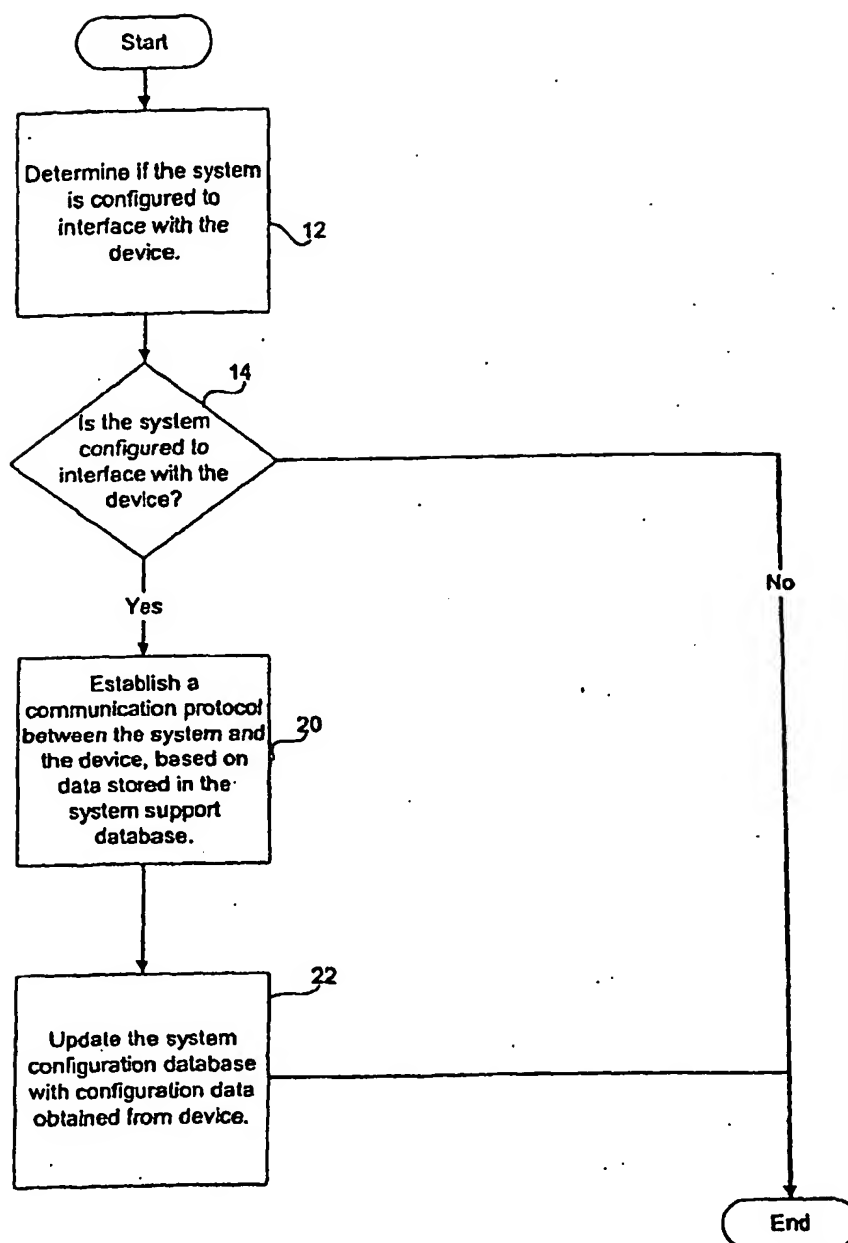


Figure 2

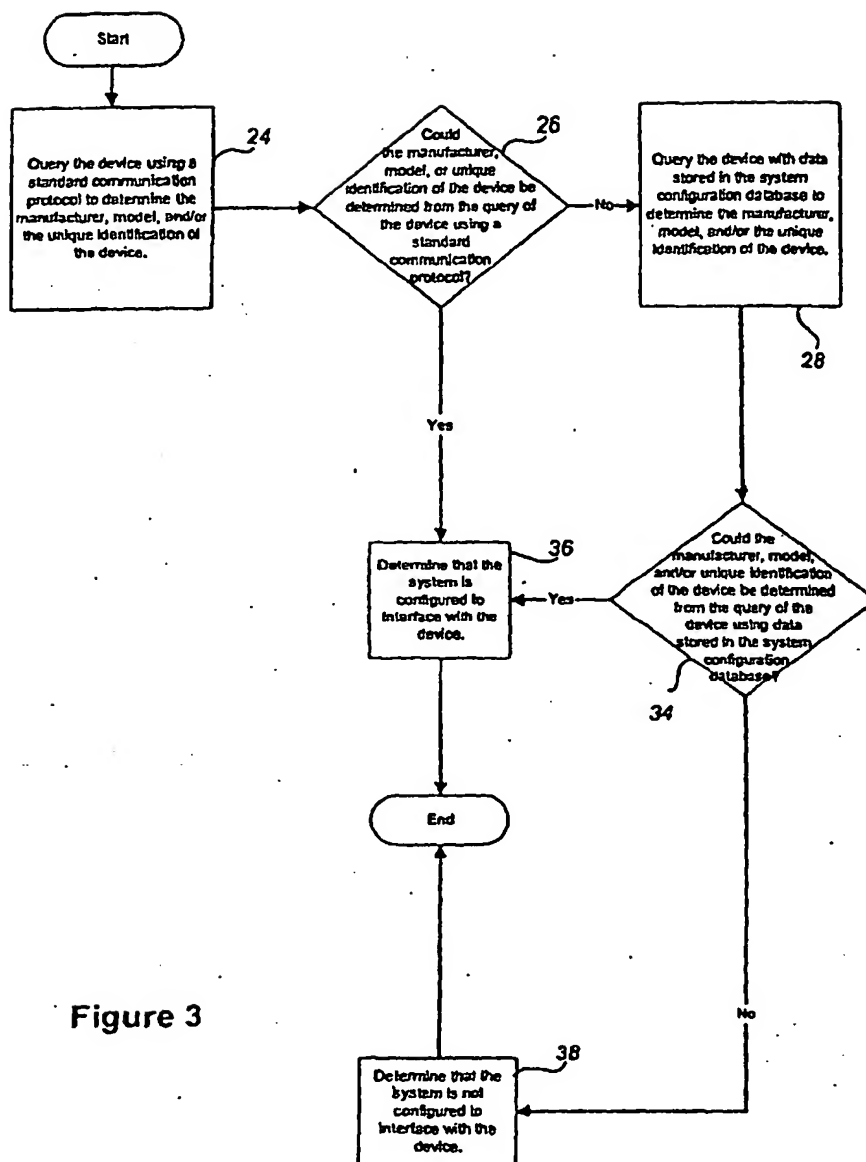


Figure 3



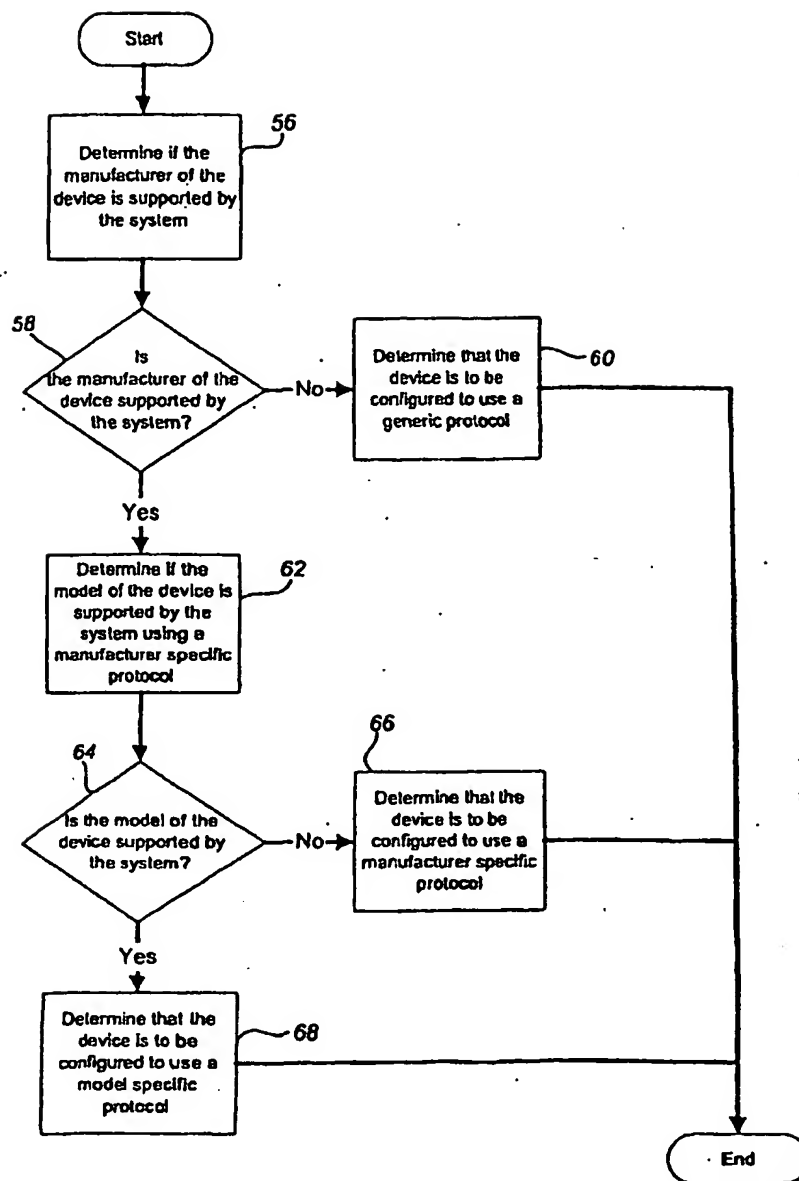


Figure 4

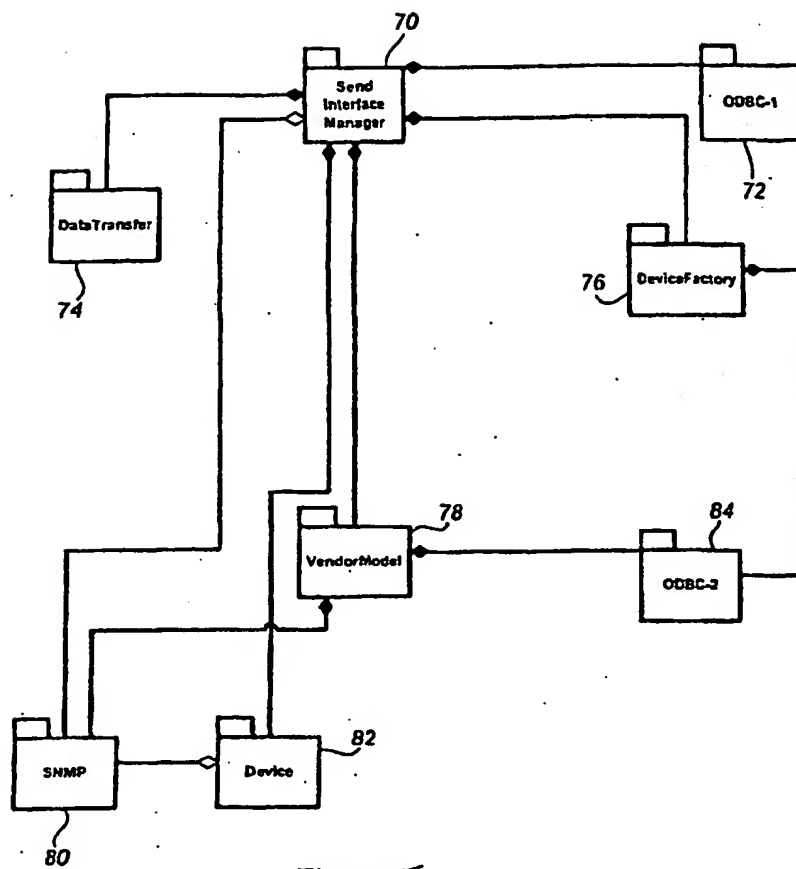


Figure 5

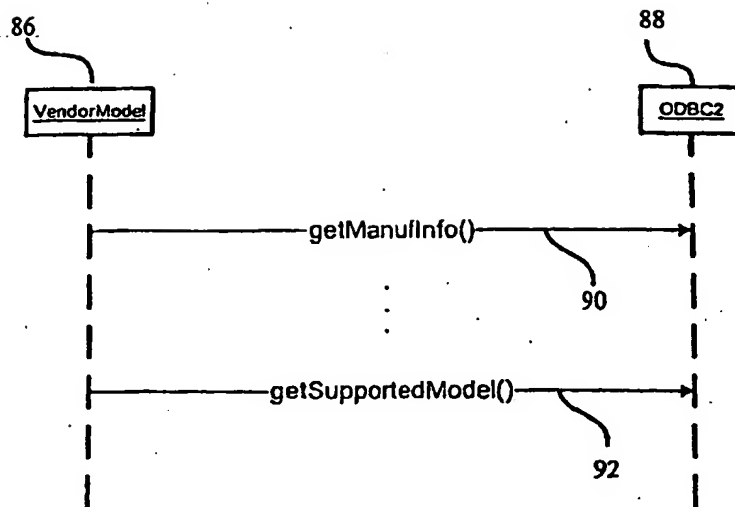


Figure 6

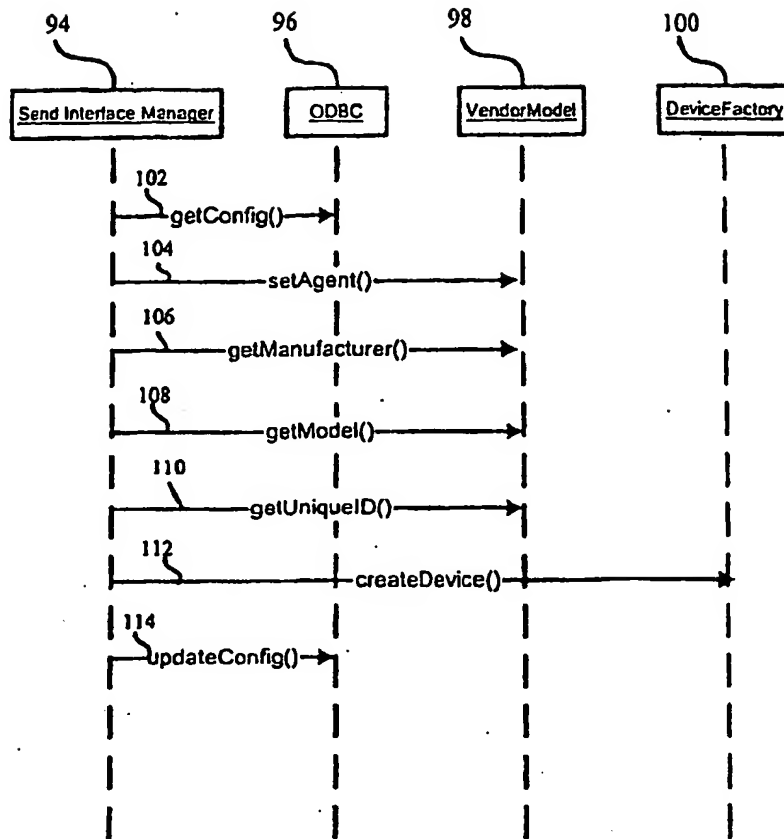


Figure 7

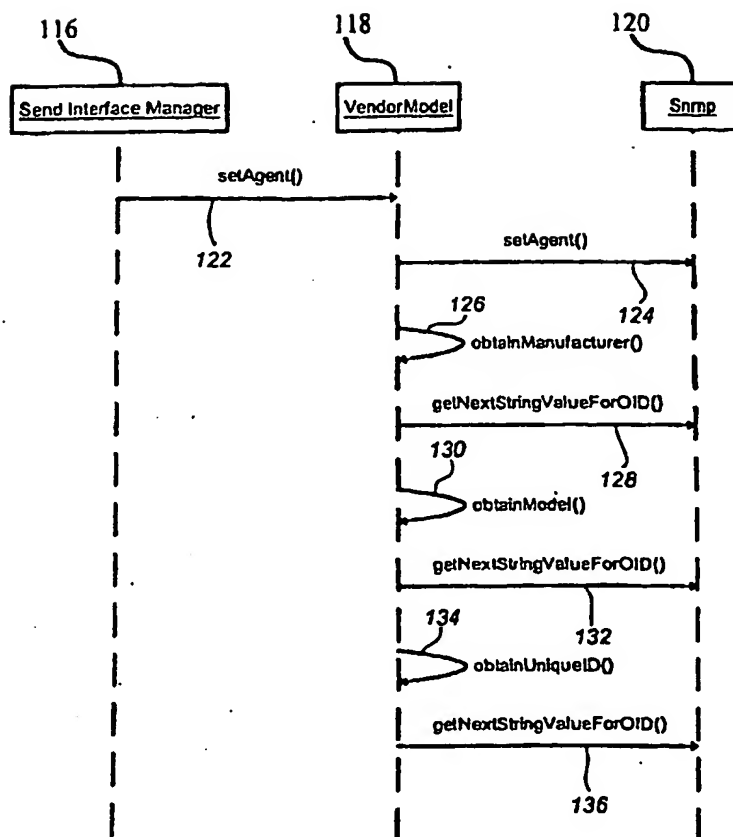


Figure 2

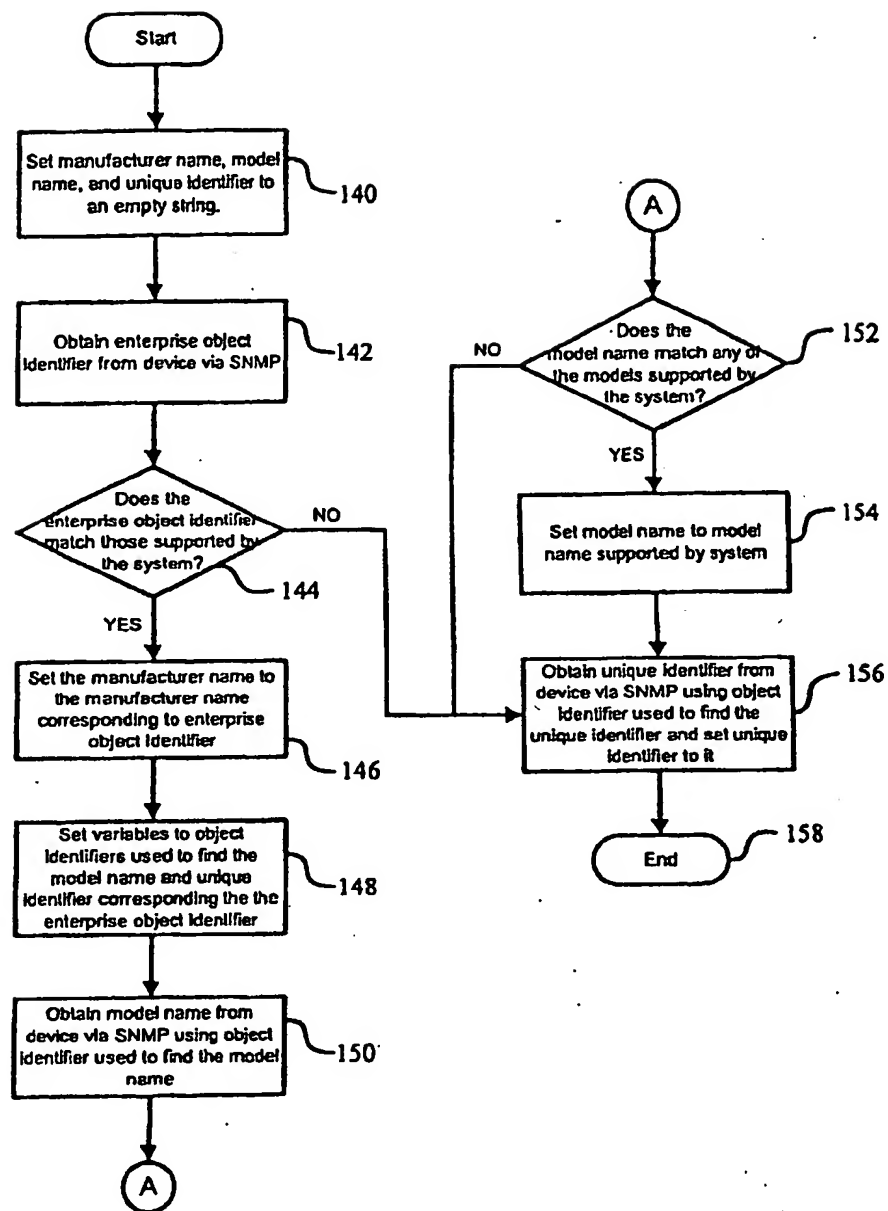


Figure 9

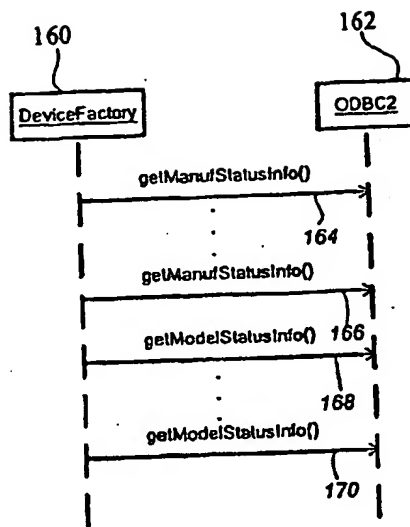


Figure 10

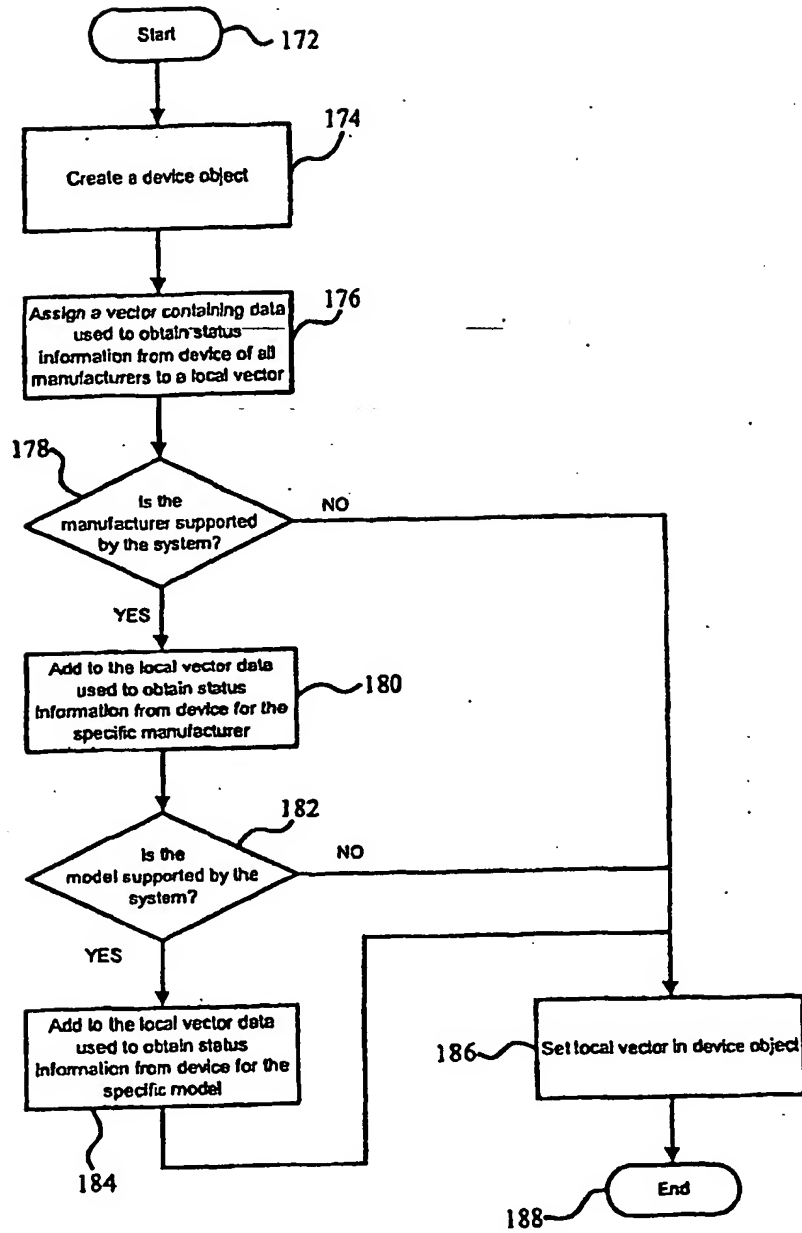


Figure 11



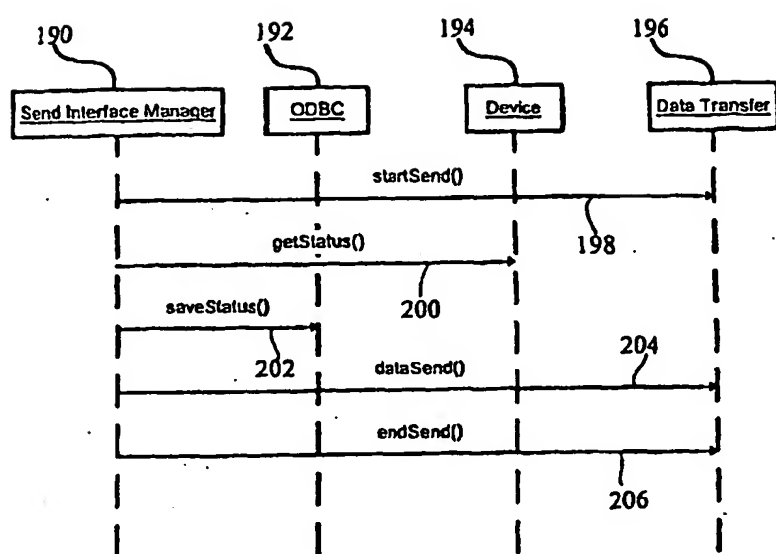


Figure 12

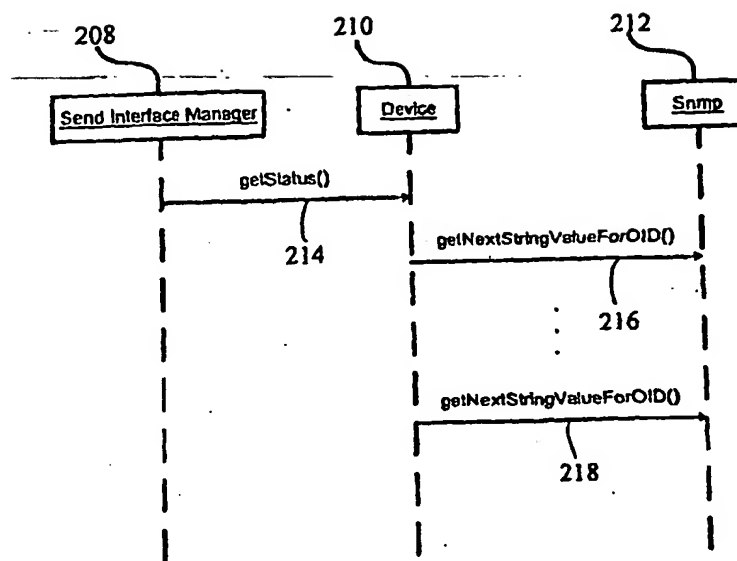


Figure 13

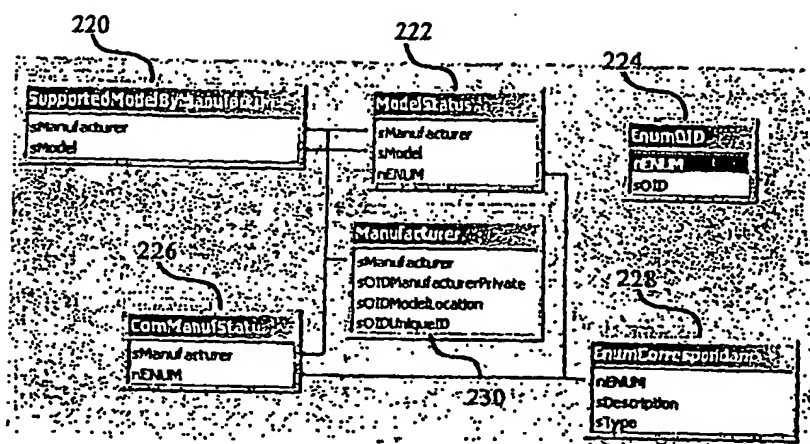


Figure 14

Microsoft Access			
File Edit View Insert Format Records Tools Window Help			
Manufacturer Table			
sManufacturer	sOIDManufacturerPin	sOIDModelLocation	sOIDUniqueID
LEXMARK	1.3.6.1.4.1.641	1.3.6.1.4.1.641.1.4.3	1.3.6.1.4.1.641.1.2.2
RICOH	1.3.6.1.4.1.367	1.3.6.1.4.1.367.3.2.1.1.1.1	1.3.6.1.4.1.367.3.2.1.2.1.4
XEROX	1.3.6.1.4.1.253	1.3.6.1.4.1.253.8.53.3.2.1.2	1.3.6.1.4.1.253.8.53.3.2.1.3
Record: 1 of 4			
Supported Model by Manufacturer		Model Status Table	
sManufacturer	sModel	sManufacturer	sModel
LEXMARK	OPTRA T616	LEXMARK	OPTRA T616
RICOH	AFICIO 1045	LEXMARK	OPTRA T616
RICOH	AP2600N	LEXMARK	OPTRA T616
RICOH	COLOR AP204	LEXMARK	OPTRA T616
RICOH	IPSIO COLOR 8000	LEXMARK	OPTRA T616
XEROX	N4025	RICOH	AP2600N
XEROX	NC60		
Record: 1 of 7		Record: 1 of 10	
Common Manufacturer Table		EnumOID Table	
sManufacturer	nENUM	nENUM	sOID
GENERIC	501	501	1.3.6.1.2.1.25.3.2.1.6
GENERIC	600	600	1.3.6.1.2.1.43.5.1.1.1
GENERIC	601	601	1.3.6.1.2.1.43.10.2.1.4
GENERIC	601	602	1.3.6.1.2.1.43.18.1.1.8.1
RICOH	2000	610	1.3.6.1.2.1.43.11.1.1.9
	0	2000	1.3.6.1.4.1.367.3.2.1.2.19.1
Record: 1 of 4		2001	1.3.6.1.4.1.367.3.2.1.2.19.2
Record: 1 of 4		Record: 1 of 10	

Figure 15

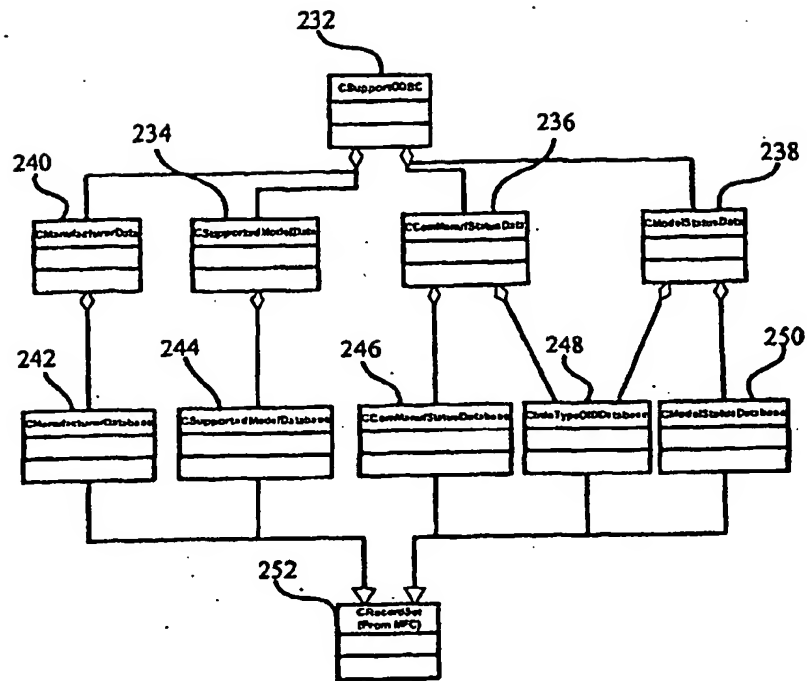


Figure 16

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